

*AUGMENTING SIMPLIFIED HABIT REVERSAL IN
THE TREATMENT OF ORAL-DIGITAL HABITS
EXHIBITED BY INDIVIDUALS WITH
MENTAL RETARDATION*

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We investigated whether a simplified habit reversal treatment eliminates fingernail biting and related oral-digital habits exhibited by individuals with mild to moderate mental retardation. Although simplified habit reversal did little to decrease the target behaviors for 3 of 4 participants, simplified habit reversal plus additional treatment procedures decreased the behavior to near-zero levels for all participants. These procedures included remote prompting, remote contingencies involving differential reinforcement plus response cost, and differential reinforcement of nail growth. Limitations of habit reversal for individuals with mental retardation along with directions for future research involving therapist-mediated treatment procedures, particularly those involving remote prompting and remote contingencies, are discussed.

DESCRIPTORS: habit disorders, nail biting, habit reversal, differential reinforcement, mental retardation

Individuals with mental retardation are frequently taught self-management skills to address a number of vocational, academic, social, and leisure skills and challenging behaviors. Self-management procedures have been used to address behavioral deficits and excesses that occur in environments for which the natural contingencies are not effective in maintaining appropriate rates of behavior (Harchik, Sherman, & Sheldon, 1992). In addition, self-management procedures are often taught with the hope of increasing generalization and maintenance in unsupervised or novel situations (Harchik et al.). Target behaviors exhibited by individuals with mental retardation addressed by self-management procedures include stereotypies (e.g., Koegel & Koegel, 1990), self-

injury (e.g., Grace, Cowart, & Matson, 1988), and aggression (e.g., Reese, Sherman, & Sheldon, 1984). Reviews of the self-management literature have found that although individuals with mental retardation can implement specific self-management procedures, more research is needed to examine the effectiveness of self-management procedures across a wide range of problem behaviors (Browder & Shapiro, 1985; Harchik et al., 1992).

One of the most studied and effective self-management procedures is habit reversal, which was originally developed by Azrin and Nunn (1973) for the treatment of nervous habits and tics. For reviews of the effects of habit reversal, see Woods and Miltenberger (1995) and Peterson, Campise, and Azrin (1994). Habit reversal has multiple treatment components, including response description and detection procedures, procedures to identify the incipient occurrence of the habit, competing response training to supplant the habit with an incompatible response, motivational procedures involving

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inconvenience review and social support strategies, and generalization procedures involving symbolic rehearsal and positive practice. Since its development, numerous studies have demonstrated the effectiveness of the habit reversal treatment package for fingernail biting and other nervous habits (Delprato, Aleh, Bambusch, & Barclay, 1977; Nunn & Azrin, 1976). In addition, simplified versions of the original habit reversal treatment (involving awareness training and competing response training) have been demonstrated to be effective for fingernail biting and other habits (De La Horne & Wilkinson, 1980; Katz, Thomas, & Williamson, 1976; Miltenberger & Fuqua, 1985).

Despite the documented success of some self-management procedures for reducing problem behaviors exhibited by individuals with mental retardation, no studies to date have examined the use of habit reversal to treat fingernail biting or related oral-digital habits exhibited by individuals with mental retardation, even though such habit behaviors are prevalent in these individuals and can pose medical risks (Long, Miltenberger, & Rapp, 1998). For example, severe fingernail biting may produce root resorption of the teeth and lead to further dental problems (Odenrick & Brattstrom, 1985). In addition, oral-digital habits (e.g., thumb sucking, finger sucking, hand mouthing) can be unsanitary and can lead to dental and health complications (Friman & Schmidt, 1989; Rankin, Jabaley, Blair, & Fraser, 1988; Turbeville & Fearnow, 1976). There is also evidence that excessive fingernail biting exhibited by individuals with mental retardation may lead to social stigma or may negatively affect how these individuals are perceived (Long, Woods, Miltenberger, Fuqua, & Boudjouk, *in press*).

Given the success of some self-management procedures used by individuals with mental retardation, an evaluation of habit re-

versal for fingernail biting in this population is warranted. If self-management were shown to be effective for habits exhibited by individuals with mental retardation, it would be preferable over caregiver-mediated interventions. The purpose of the following investigation was to examine whether a simplified habit reversal (SHR) procedure (e.g., Miltenberger, Fuqua, & McKinley, 1985) would eliminate fingernail biting and related oral-digital habits exhibited by individuals with mild to moderate mental retardation, and to evaluate adjunct procedures if habit reversal failed. We chose the habit reversal components of awareness training, competing response training, and social support because these three components have been shown to be effective for a variety of habit behaviors (e.g., Woods & Miltenberger, 1995). The adjunct procedures provided additional contingencies in the natural environment to support the successful use of the competing response.

METHOD

Participants

Four individuals who engaged in fingernail biting and related oral-digital habits were recruited from an upper midwest city through advertisements placed in various residential agencies and vocational training centers serving individuals with mental retardation. To participate in the study, participants were required (a) to be diagnosed with mental retardation, (b) to exhibit fingernail biting and related oral-digital habit behavior at least two times per week during the past 30 days, and (c) to be able to follow instructions to engage in the habit reversal procedure.

Dee, a 24-year-old man who had been diagnosed with pervasive developmental disorder, mental retardation (unspecified), and seizure disorder, exhibited two finger-to-mouth behaviors, excessive thumb sucking

and fingernail biting. Dee's group-home staff and mother reported that he had sucked his thumb throughout his life. His fingernail biting reportedly occurred often, although noticeable fingernail damage was not evident. Both behaviors were reported to be most likely to occur when Dee was alone in his room. Both finger-to-mouth behaviors, defined as any time Dee placed any of his fingers (including his thumb) past his lips, were targeted for treatment. Dee was almost completely nonverbal and had limited sign language capabilities. He demonstrated four to five signs throughout participation in the study. Dee had spent most of his life in an institution, although he had been living in his current group home for the past 6 years. Dee received haloperidol throughout the study.

Ned, a 32-year-old man with moderate mental retardation, had severe damage to the fingernails on both of his hands. Four of his fingers on his left hand had no noticeable fingernails. Ned also picked at the skin around his cuticles and the sides of his fingers. Both nail biting and skin picking were targeted for treatment. Fingernail biting was defined as any time Ned placed a finger inside his mouth. Skin picking was defined as any time Ned placed his index finger and thumb from the same hand on the fingernail or sides of the fingernail found on the opposite hand. Ned's fingernail biting and skin picking were reported to be most likely to occur when he was watching television. Ned had good receptive language, although his expressive language abilities were limited. He lived in an apartment with one other individual and support staff. Ned received no medication throughout the study.

Jed, a 34-year-old man with mild mental retardation and cerebral palsy, bit his fingernails. Fingernail biting was defined as occurring any time he placed a finger inside his mouth. Jed reported fingernail biting since he was a child. He stated that he fre-

quently bit his nails at work and when he was "stressed out." Jed's work staff agreed with this and noted that he usually bit late in the workday. Jed had excellent expressive and receptive language abilities. He stated that he did not like the appearance of his fingernails and that he had tried unsuccessfully to stop biting on his own before the study. He lived in a group home with support staff. Jed was not receiving any medication at the time of the study.

Kat was a 24-year-old woman with moderate mental retardation, tonic-clonic seizure disorder, spastic diplegia, and cerebral palsy. She exhibited excessive hand-to-mouth behaviors including finger sucking (including her thumb) as well as occasional fingernail biting, hand biting, and hand mouthing (placing her fist into her mouth). These hand-to-mouth behaviors, defined as occurring any time Kat placed any part of her hands or fingers to her lips, were targeted for treatment. According to staff, these behaviors occurred throughout the entire day but were most likely to occur while she was watching television or was alone in her room. Kat was predominantly nonverbal and communicated generally through gesturing and sign language. She lived in an apartment with one other roommate and support staff. Throughout the study, she was taking carbamazepine for seizure control.

Data Collection

Videotape assessment of the participants occurred in situations that had been identified by staff persons as being associated with high levels of the target behaviors. A varying number of sessions were conducted for each participant due to their variable daily schedules. Four to 25 videotape samples (10 min each) were recorded per week in baseline and posttreatment sessions. Videotape samples were scored for the percentage of time the participant engaged in the target behaviors using the percentage duration method (as

described by Miltenberger, Long, Rapp, Lumley, & Elliott, 1998) in which the presence or absence of the behavior was recorded on a second-by-second basis throughout the observation period. Percentages were calculated by dividing the number of seconds of occurrence of the target behavior by the total number of seconds in each 10-min sample (600 s).

For Dee, videotape samples were collected through a one-way mirror in a university meeting room (3 m by 4 m) while he was watching television. He sat in a recliner and watched television in the meeting room in the same way he did in his room at the group home. Dee had a history of destroying property, and staff suggested that the monitored room at the university was preferable to a camera in his room for conducting assessment sessions. In addition to assessment sessions, all treatment procedures for Dee were implemented in the meeting room.

For Ned and Kat, the experimenters brought a videocamera to their respective apartments and placed it in sight in the corner of the living room. Videotape samples were collected while they watched their favorite television shows. All assessment sessions and treatment procedures occurred in these rooms.

For Jed, videotape samples were collected via a videocamera positioned on a shelf at the side of the room in the sheltered workshop during the afternoon while he was working. Jed stated that his fingernail biting occurred most frequently in the workshop and that he preferred that assessment and treatment procedures be implemented there. Treatment procedures were implemented in the workshop after business hours. Fingernail measurements, from the base of the fingernail to the top of the fingernail, were taken approximately once a week throughout the study.

Interobserver Agreement

A second rater scored 30% of the assessment videos for the occurrence of the target

behavior for the 4 participants across all phases of the study. Percentage of interobserver agreement was calculated by dividing the number of seconds in the session in which the two independent observers agreed on the occurrence or nonoccurrence of the target behavior by the total number of seconds in the session and multiplying this number by 100%. An agreement was scored when the onset or offset of the behavior was scored no more than 1 s apart by the two observers. For Dee, mean interobserver agreement for finger-to-mouth behavior was 99.8% (range, 90.1% to 100%). For Ned, mean interobserver agreements were 99.7% (range, 97.3% to 100%) for his fingernail biting and 99.1% (range, 92.1% to 100%) for his skin picking. For Jed, mean interobserver agreement for fingernail biting was 99.9% (range, 98.7% to 100%). For Kat, mean interobserver agreement for hand-to-mouth behavior was 99.2% (range, 93.2% to 100%).

For Jed, 50% of the fingernail measurements were completed by two independent observers. A metric ruler was placed at the base of the fingernail and the observers separately recorded the measurement to the top of the fingernail. A percentage of interobserver agreement was calculated by dividing the number of measurements with agreements by 10 (the number of nails measured) and multiplying this number by 100%. An agreement was scored when both observers independently recorded the same measurement. Mean interobserver agreement was 96.3% (range, 80.0% to 100%).

Experimental Design

The experiment utilized a multiple baseline across subjects design. The initial intervention phase for all participants consisted of SHR, which involved awareness training, competing response training, and social support with booster sessions as needed. Additional treatment procedures were imple-

mented only after a minimum of four booster sessions had failed to decrease the target behavior to near-zero levels. For Dee, an additional treatment component of remote prompting was added. For Ned and Kat, additional treatment phases included the implementation of remote contingencies involving differential reinforcement plus response cost. For Jed, the additional treatment included differential reinforcement of nail growth (DRNG).

Procedure

Before baseline, the experiment was explained to the participants and their legal guardians. The participants and their legal guardians signed consent forms indicating that they would participate in the experiment and that they agreed to allow video recording. All treatment sessions were conducted by two clinical psychology graduate students trained in the assessment and treatment procedures.

Baseline. Videotape assessments were conducted for 5 to 10 weeks.

Simplified habit reversal. Treatment, implemented in two 50-min sessions conducted on consecutive days, consisted of awareness training, competing response training, and social support.

For awareness training, the participants were taught to identify each instance of their target behavior. Dee and Kat demonstrated how they performed their target behaviors. Ned and Jed described and demonstrated how they engaged in their target behaviors. To facilitate awareness training, the experimenter then provided physical resistance to the arms of the participant while he or she practiced bringing the hands to the mouth. The participant simulated his or her target behaviors 10 to 15 times in the session. In addition, for all participants a game was played in which they would either announce or gesture when the experimenters brought their hands and fingers to their mouths.

For competing response training, Dee and Kat were assigned competing responses by the experimenters. The experimenters assisted both Ned and Jed in selecting competing responses for their target behaviors. Dee's and Kat's competing responses consisted of sitting on their hands. Ned's competing responses included folding his arms across his chest, sitting on his hands, placing his hands in his pockets, and making fists with both of his hands. Jed's competing responses involved folding his arms and sitting on his hands. After identifying competing responses, participants practiced implementing them noncontingently. Participants were also instructed to do their exercises and hold the competing response for approximately 1 min contingent on their simulation of the target behavior. Participants were instructed to do their competing responses each time they detected an instance of their target behavior outside of the training session. All subjects were compliant with verbal instructions to do their exercises.

For social support, the experimenters met with Dee's, Ned's, and Kat's residential staff and Jed's workshop staff. Staff persons were asked to praise the participants when they were not engaging in their target behaviors in the high-probability situations, to praise the participants when they were using their competing responses, and to remind the participants to use their competing responses if they were engaging in a target behavior.

Following the completion of the initial two treatment sessions, assessment sessions were conducted. If the target behaviors were not reduced by at least 75% from baseline, booster sessions were implemented. The 30-min booster session consisted of a review of the treatment procedures and practice in simulating the target behavior and using the competing response. If, after four to six booster sessions, the target behaviors were not at zero or near zero (0% to 3%) per-

centage duration, additional contingencies were implemented.

Remote prompting. This phase of treatment began with Dee watching television in the university meeting room. Dee was observed through a one-way mirror by an investigator. If at any time during this treatment phase Dee engaged in his target behavior, the experimenter verbally prompted him to do his exercises via a speaker mounted on the wall. Dee was prompted eight times throughout the 13 assessment sessions during this treatment phase, with no more than two verbal prompts needed per session. The remote prompting procedure was chosen because Dee's use of the competing response was under very good instructional control and the instructions could be given under the stimulus control of being alone in a room, similar to the circumstances in which the habit behavior was most likely to occur in the natural environment.

Differential reinforcement of zero responding and alternative behaviors plus response cost (DRO/A + RC). Contingencies mediated by the experimenters were implemented after the SHR procedure failed to reduce target behaviors for both Ned and Kat. However, for both participants the contingencies were implemented while each was alone and engaged in activities during which the target behaviors were highly likely to occur, in order to develop stimulus control over the behavior in those situations. Using a procedure similar to Cowdery, Iwata, and Pace (1990) and Long, Miltenberger, and Rapp (in press), Ned was left alone in his living room to watch television without being told that the researchers were observing him on a television monitor in the other room. At the beginning of each session, the investigator informed him that "I have to leave the room but I will be back shortly" and asked him not to place his hand or fingers in his mouth. The investigator then observed him from another room using a portable televi-

sion connected to the assessment camera. The DRO/A interval was set initially at 30 s, and at the end of the interval, the investigator entered the room, praised Ned for not engaging in the target behaviors, and placed 1 dime in a clear plastic cup located on the television. If Ned was engaged in one of his competing responses when the investigator entered, he was praised for doing his exercises and 3 dimes were placed in the cup. If a target behavior occurred at any time during the interval, the investigator quickly entered the room, asked Ned to engage in a competing response, and then removed 1 dime. After prompting him to engage in a competing response, the interval length was reset to 30 s and the interval length was extended by increments of 60 s after each reinforcer delivery until either an instance of the target behavior occurred or 10 min elapsed (the length of the assessment sessions). These procedures were used with Kat, except that candies were used instead of dimes. For Ned, these contingencies were in effect throughout the phase. For Kat, this treatment phase consisted of one initial treatment session and a booster session, in which the procedures were implemented as described above. However, after the 1-hr treatment session, contingencies were not provided for the occurrence of the target behavior.

Differential reinforcement of nail growth. For Jed, differential reinforcement of nail growth was added to the original simplified habit reversal procedures. The experimenters explained to Jed that he would earn \$5 at the end of 7 days if there was no noticeable fingernail damage and all of his fingernails had grown or remained the same length. Jed earned the \$5 four times out of eight possible opportunities throughout the phase.

Treatment Compliance

Treatment compliance measures were taken throughout the simplified habit reversal

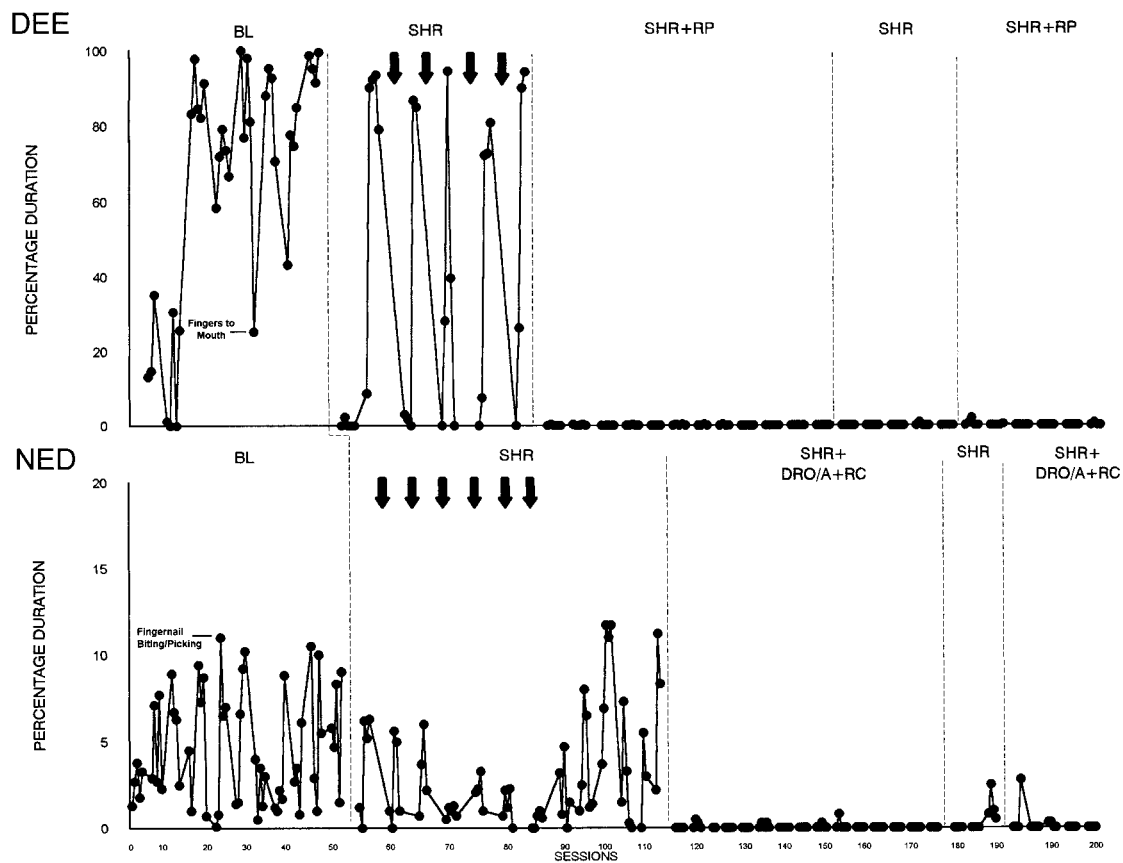


Figure 1. Percentage duration of finger-to-mouth behavior for Dee and fingernail biting and skin picking for Ned across experimental conditions. Arrows indicate booster sessions.

treatment phase. Participants were asked 10 times throughout booster sessions to “do your exercises.” Treatment compliance was scored by a graduate student, who analyzed videotapes of the booster sessions. A percentage of compliance was calculated by dividing the number of times the participants did their exercises successfully by the total number of times the participants were asked to do their exercises. This number was multiplied by 100%. A successful exercise was defined as occurring when the participant performed an appropriate competing response within 5 s of the instruction, without additional verbal prompting, and without physical assistance from the experimenters.

RESULTS

The percentage duration of the target behaviors across baseline and treatment phases for all participants is shown in Figures 1 and 2.

Dee

During baseline, the mean duration of Dee’s finger-to-mouth behavior was 65.9%. When SHR and subsequent booster sessions were implemented, there was only a transient decrease in the behavior, with a phase mean of 39.6%. During the remote prompting phase, finger-to-mouth behavior immediately decreased to near zero, with a phase mean of 0.04%. After five consecutive as-

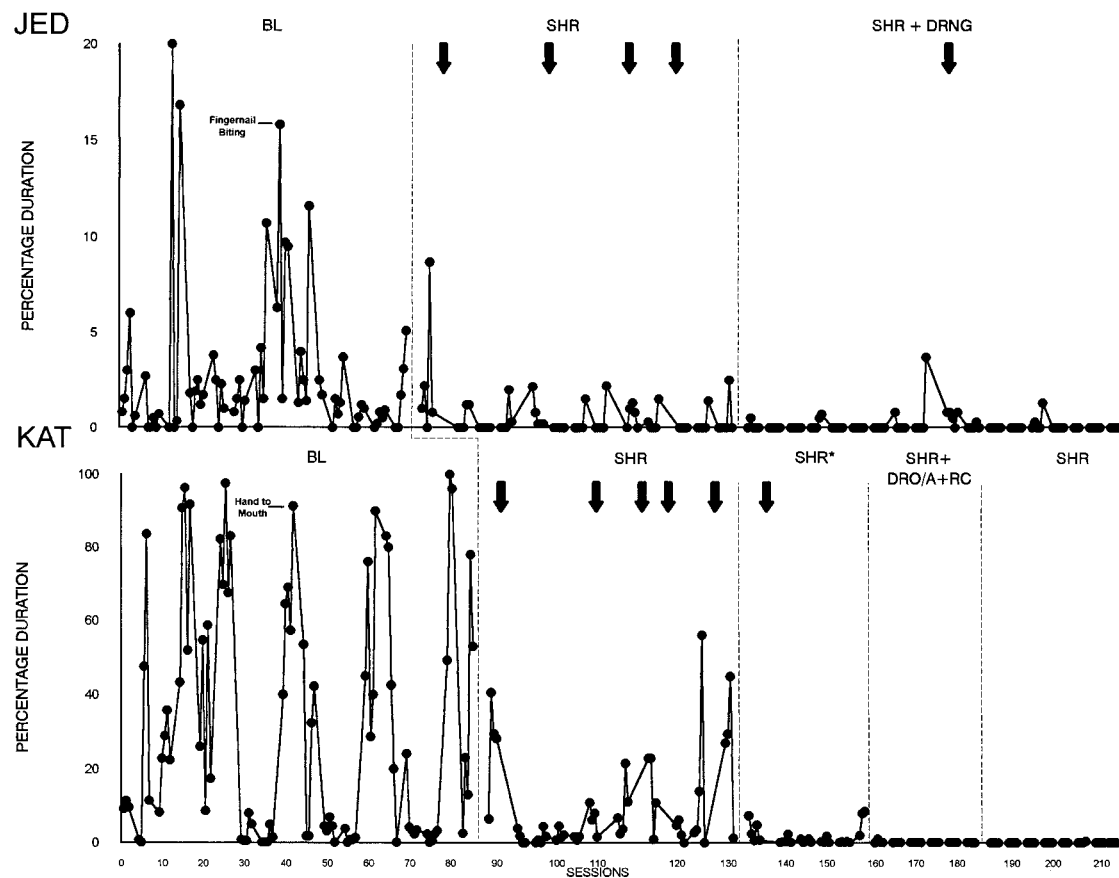


Figure 2. Percentage duration of nail biting for Jed and hand-to-mouth behavior for Kat across experimental conditions. Arrows indicate booster sessions.

assessment sessions resulting in zero levels of behavior, remote prompting contingencies were discontinued. The target behavior was noted again in the fourth assessment session of this phase ($M = 0.07\%$). A return to remote prompting was then implemented, and the verbal prompt was provided contingent upon the occurrence of the target behavior. The mean of the final remote prompting phase was 0.04% , with a near-zero level of the behavior for 6 weeks.

Ned

The mean durations of fingernail biting and skin picking during the baseline phase were 1.6% and 2.9% , respectively. After the implementation of SHR and six booster ses-

sions, there was a gradual reduction in fingernail biting and skin picking to near-zero levels. After a 2-week period without booster sessions, both fingernail biting and skin picking returned to baseline levels. The mean of the SHR treatment phase for fingernail biting was 0.9% and for skin picking was 2.3% . When the DRO/A+RC phase of treatment began, an immediate reduction to near-zero levels of the behaviors was attained and continued for 15 assessment sessions. The mean of the DRO/A+RC phase for fingernail biting was 0.03% and for skin picking was 0% . Following five consecutive sessions with a zero rate of the behaviors, the SHR phase began again in which Ned experienced no contingencies for the occur-

rence of his target behaviors. The mean for this phase for fingernail biting was 0.21% and for skin picking was 0.19%. Upon the occurrence of an increased level of fingernail biting and skin picking, a return to the DRO/A+RC phase was implemented. The mean in this phase for fingernail biting was 0.12% and for skin picking was 0.05%, with zero to near-zero levels of both behaviors maintained over 4 weeks.

Jed

The mean duration of fingernail biting during baseline was 2.7%. Following the implementation of the SHR treatment with four booster sessions, Jed's nail biting decreased to a mean of 0.5%. Although the SHR treatment phase had reduced the percentage of time Jed exhibited fingernail biting, he was still causing fingernail damage. Implementation of the DRNG phase with one booster session resulted in a mean duration of 0.13%. Following the booster session, lower levels of the behavior were maintained for 5 weeks.

Jed's fingernail length was relatively stable during baseline, with increases of 1 to 4 mm occurring for almost all fingers by the end of the SHR phase. Further growth or stability in length was evident for each nail by the end of the DRNG phase. At the end of the DRNG phase, Jed said that he was satisfied with the length of all of his fingernails.

Kat

Kat's hand-to-mouth behavior was highly variable during baseline with a mean duration of 31.6%. Implementation of SHR with five booster sessions did not produce a sustained reduction in the behavior, with a mean duration of 9.87%. Following one session of differential reinforcement and response cost with one booster session, assessment sessions without contingencies indicated a reduction to low levels, but the reductions were not maintained. The mean

duration was 1.59%. During the next DRO/A+RC phase, contingencies were implemented during assessment sessions, resulting in an immediate decrease to near zero. The final five assessment sessions resulted in zero levels of behavior. The SHR phase was again implemented in which contingencies were not provided for the occurrence of the target behavior in the assessment sessions, resulting in a mean duration of 0.01%.

Treatment Compliance

All participants correctly demonstrated their competing responses an average of 93.7% of the time (range, 90% to 97.5%) when verbally instructed to do so during booster sessions. This indicates that treatment results were not due to the participant's inability to perform his or her competing responses.

DISCUSSION

This study examined the effects of a self-management procedure for the treatment of fingernail biting and related oral-digital habits exhibited by individuals with mental retardation. Only Jed exhibited gains from SHR as evidenced by a sustained reduction in nail biting and improvements in fingernail growth. The other 3 participants' target behaviors returned to near-baseline levels by the end of the SHR phase. The SHR procedure was clearly not effective without the addition of experimenter-manipulated contingencies.

Although SHR did little to reduce the target behavior for 3 participants, the addition of the remote contingencies resulted in dramatic reductions for all 3. One important aspect of the remote contingencies is that the habit behavior can be eliminated in the natural context when contingencies are implemented in that context. For these participants, the natural context for the behavior was being alone, perhaps due to social pun-

ishment for the behavior in the presence of others such as staff, teachers, and parents. Our remote contingencies were successful because they were implemented in situations that were discriminative for the behavior (alone watching television). Thus, the potential for the behavior change to generalize to all alone situations may have been heightened. Although assessment and treatment occurred in situations that had been identified as being most likely for the target behavior to occur, without assessment in multiple settings we cannot ascertain whether fingernail biting and related oral-digital habit behaviors decreased in other settings. The exception to this was Jed, for whom reliable measurements of his fingernail growth provided evidence of reduced nail biting across all settings. Future studies need to incorporate additional assessment measures to ensure that treatment gains generalize and are maintained across multiple settings.

An important question from the results of this study is why SHR failed to be effective even though all individuals learned the competing response and demonstrated its correct use in the presence of the therapist. One possible account is that although the clients learned the necessary skills to control their habit behaviors, there were no reinforcement contingencies in place in the natural environment to maintain the use of the skills. Although all subjects had staff who were trained to implement the social support contingencies, according to their own reports they rarely did so, even after repeated reminders from the experimenters. The addition of the remote contingencies amounted to enhanced social support by the researchers in the natural environment in that the subjects received reinforcers for the use of the competing response or the absence of the habit behavior and prompts to use the competing response when the habit occurred.

Another explanation for the ineffectiveness of SHR is that participants with more

severe mental retardation and developmental disabilities may not experience, or may be less responsive to, negative social consequences resulting from their habit behaviors. Perhaps what facilitates the independent use of SHR is the experience of negative social consequences (e.g., verbal disapproval) that results from either the performance of the habit behavior or the ensuing response products. Thus, if no negative social consequences result from habit behaviors, perhaps individuals are less likely to independently implement self-management procedures for the habit behaviors. The 1 participant who was embarrassed by the damage to his nails (Jed) was the one to benefit most from SHR. Future research is needed to predict when participants are likely to benefit from SHR.

For Jed, the addition of reinforcement for nail growth led to substantially reduced levels of fingernail biting. Furthermore, with the DRNG schedule, the length of his fingernails increased. Addition of the DRNG phase took minimal time to execute (5 min per week to measure fingernails) and was affordable (\$5 per week if the objective was accomplished). Thus, it is conceivable that such a procedure would be adopted by residential and vocational staff for use in applied settings.

There are a number of limitations in the present investigation that need to be addressed. First, there is a problem with order effects because the additional contingencies always followed the SHR phase. Future research is needed to determine whether the prior use of SHR is necessary for the effectiveness of remote contingencies.

Although the participants met the three inclusion criteria we established, they differed in their abilities to communicate and the severity of their fingernail biting and oral-digital habits. A second limitation of this study is this heterogeneity, which limits the generalizability of the results. Future research is needed on more homogeneous co-

horts that may determine specific characteristics or skills for which the procedures can be used effectively.

A third limitation is the practicality of conducting the intervention in applied settings. Staff members who work with individuals with fingernail biting or oral-digital habits may not have the time to monitor and implement the remote contingencies as described in this investigation. However, for more severe behavior disorders (e.g., self-injurious behaviors) that occur when individuals are alone, the time and effort needed to implement the remote contingencies may be warranted (e.g., Cowdery et al., 1990). The challenge for researchers is to develop practical treatments that can be implemented when the change agent is not physically present (e.g., Long, Miltenberger, & Rapp, in press). Based on the results from the remote contingencies in this study, we have modified our social support procedures when using SHR clinically with children with habit behaviors. We instruct parents to enter the room (where their child is watching television alone) on a frequent but unpredictable basis (every 5 to 15 min) and implement social support contingencies when their child typically engages in a habit behavior in such situations while alone.

A fourth limitation of this investigation is that we collected data only in limited situations for each individual. However, the individuals were reported to engage in the target behavior primarily in these situations. Furthermore, unlike many investigations in which data are collected in analogue circumstances or inpatient settings, the data were collected in the natural environment or in a situation that closely simulated the natural environment (for Dee). To improve data collection in this investigation, observations could have been conducted by staff on a time-sampling basis at other times and under other circumstances.

Because a functional analysis of the habit

behaviors was not conducted, the competing responses utilized by the participants were not determined to be functionally equivalent to the habit behaviors. Hence, we did not establish that they resulted in reinforcing contingencies equivalent to the habit behaviors. The competing responses interrupted and competed with the execution of the habit behavior, similar to competing responses reported in past habit reversal studies (e.g., Rapp, Miltenberger, Long, Elliott, & Lumley, 1998). Further study examining the effects of functionally equivalent competing responses is necessary.

Habit reversal or other self-management treatments of fingernail biting and related oral-digital habits exhibited by individuals with mental retardation have been previously unexamined. This research demonstrates the difficulty in treating such habits with SHR procedures, but points to a method that may be effective when used in conjunction with SHR, especially if modified to be less time and effort intensive. Further research is needed to develop effective self-management procedures to establish practical, efficient, and effective treatment for individuals with mental retardation.

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STUDY QUESTIONS

1. What was the problem behavior for each participant, and under what conditions was it most likely to occur?
2. What was the dependent variable in the study, and how was it measured? What other measurement procedure would have yielded the same outcome?
3. Describe the three components of simplified habit reversal (SHR) and the behavioral processes that these components most likely represented.

4. What supplemental procedures were added to the treatment program?
5. Describe the experimental designs used to evaluate the effects of SHR and the supplemental interventions.
6. Based on results obtained for each participant, what were the apparent effects of SHR and the supplemental interventions?
7. What additional data may have been helpful in evaluating the role of the competing responses?
8. Describe several methods that might have been used to strengthen the positive reinforcement contingencies contained in the SHR intervention.

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